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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,878	06/28/2001	Jun Dong Kim	08245.0027	3043
22852	7590	03/31/2004	EXAMINER	
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP 1300 I STREET, NW WASHINGTON, DC 20005			RAO, SHRINIVAS H	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 03/31/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/892,878	KIM ET AL.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 November 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4 and 11-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1,3-4 and 11-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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Response to Amendment

Applicants' amendment filed on December 11, 2003 has been entered on January 31, 2004.

Therefore claims 1,3,4,11,12 and 13 as recited in the amendment and presently newly added claims 14-21 are currently pending in the Application.

Claims 2 and 5-10 were previously cancelled.

AMENDMENT

The amendment filed on December 11, 2003 has been signed by only Mr. Qingyu Yin who has limited recognition under 37 CFR Section 10.9(b) till June 6, 2004.

As the application indicated that the Attorney of record is Ernest F. Chapman (25,961) and other Attorneys who have previously filed papers in this case and the Applicant is a client of the firm of Finnegan, Henderson and it is assumed that Mr. Qingyu , as required by his conditional recognition would have informed the USPTO of any change in his status as a lawful resident of U.S. and is currently employed by Finnegan, Henderson and further Mr. Qingyu Yin remains in U.S. on an H-1B visa thus complying with all the requirements of his limited recognition, the amendment is acceptable.

Claim Objections

Newly presented claims 15,17,19 and 21 are objected to for the following reasons :

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Claims 15, 17 recite "siloxanis " and " silicesquinoxanis" , it is believed Applicants' mean to recite " siloxanes" and " silsesquioxanes" , if this is correct, then the correct spelling of the above mentioned compounds should be substituted in all occurrences.

Claim Rejections - 35 USC § 103

Claims 1-4, and 11-13 , and 14-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye et al. (U.S. Patent No. 6,080,529 herein after Ye) in view of Lau et al. (U.S. Patent No. 5,173,542, herein after Lau) for reasons previously set out and reproduced below for ready reference.

It is noted that Applicants' have not amended any of the previously pending claims 1,3,4 and 11-13 and only added presently new claims 14-21 by the amendment.

For response to Applicants' arguments see " response to arguments section" below.

With respect to claim 1 and 11 Ye describes a method of forming gate electrodes of a semiconductor device including the steps of: forming a gate insulation layer over the semiconductor wafer (Ye col. 11 lines 36-38, silicon dioxide layer not shown in the drawings), forming a conductive layer over the gate insulation layer (Ye fig. 2a # 216, col. 11 line 41), forming a low-dielectric layer over the conductive layer (Ye fig. 2A # 218, col. 11 line 42), forming a photo resist pattern whose width is equal to the exposure limit on the low dielectric layer (Ye layer 224 or 324, col. 21 lines 55-65, col. 22 lines 1-2 , col. 6 lines 5-21, especially line 18), patterning the low dielectric layer using the

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photo resist pattern as a mask (Fig. 2c , col. 6 lines 9- 18, col. 12 lines 28-32), removing photo resist pattern (col.11 lines 33-34), shrinking the low dielectric pattern.

Ye does not specifically mention shrinking the low dielectric pattern.

However, Lau, a patent from the same filed of endeavor (both Ye and Lau deal low dielectric layers made from organic polymers including PTFE, etc. see claim 3 of Ye and col. 1 lines 20-37 of Lau) describes the standard procedure of the shrinking the low-dielectric pattern by curing the low-dielectric pattern (Lau in col.14 line 37 and claim 11 © curing , similar to the Applicants' specification at least pages 6-7 para 16) to cross link the polymers.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Lau's curing (i.e. shrinking of dielectric) step in Ye's method steps to cross-link the polymer of the low dielectric layer . (Lau col. 1 lines 49-61).

Forming gate electrodes by patterning the conductive layer and the gate insulation layer using the shrunken low dielectric layer pattern as a mask (Figs. 3D and 2 B, col. 11 lines 66- col. 12 lines 32, col. 15 lines 6-10). (it is noted that Ye teaches at least two separate embodiments in figs. 2A—G and 3 A-G, however Ye in at least col. 15 lines 5-8 teaches the steps of embodiments in figs. 2 and 3 are interchangeably used).

It is noted that the order of performing the step of shrinking the low-dielectric pattern before/after removal of the photoresist pattern is different in claims 1 and 11.

However, it is well settled law that the order of performing method steps is prima facie obvious. " As a matter of fact selection of any order of performing process steps is

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prima facie obvious in the absence of new or unexpected results. In *Re Burhaus*, 154 F.2d. 690,69 USPQ 330 (CCPA 1946). See also *Ex parte Rubin*, 126 USPQ 440 (BAPI 1959) and *In re Gibson*, 39 F.2d 975, 5 USPQ 230 (CCPA 1930).

Therefore irrespective of the order of performing the step/s the recited claims are prima facie obvious the applied prior art.

With respect to claim 2 wherein the low-dielectric layer is formed of an organic spin-on glass or inorganic spin-on glass layer. (Ye col. 6 lines 22-26-organic low k dielectric materials and col. 14 line 65-66 glass-like siloxane) .

With respect to claim 3 wherein the forming of the low –dielectric layer comprises : depositing low dielectric layer over the conductive layer for the gate electrodes (fig.2 G # 230, col. 13 lines 55-60) and soft –baking the low-dielectric layer at a predetermined temperature .

Ye does not specifically describe soft-baking its low-dielectric layer at a predetermined temperature.

However, Lau, a patent from the same filed of endeavor describes in col. 14 line 35 the standard procedure of soft –baking the low dielectric is soft baked after its application to drive off any remaining solvents from the mixture applied.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Lau standard “ soft-baking step in Ye’s method to remove any excess liquid remaining after the application of the dielectric polymer mixture on the wafer. (Lau col.14 Line 36).

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With respect to claims 4 and 13 , wherein the shrinking the low-dielectric pattern by curing the low-dielectric pattern at 400-500 degrees centigrade. (Lau in col.14 line 37 and claim 11 © curing at 300-450 degrees to cross link the polymers). Therefore it would have been obvious to curing between 400-500 degrees without more because it was previously done in the over lapping range of 300-450 degrees.

With respect to claim 6, to the extent understood, it recites the same steps as claim 1 except for reciting, “ a material layer” instead of a “conductive layer “ in claim 1 and rejected for the same reasons as stated above under claim 1 . (It is noted that the sequence of performing the process steps is slightly changed in claim 6, however as well settled case law (Exparte Rubin and In re Burhaus , any order of performing steps is prima facie obvious in absence of new or unexpected results).

With respect to claim 12 wherein forming the low dielectric layer includes, depositing a low-dielectric layer over the conductive layer. (rejected for the same reasons as stated under claims 1 and 11 above).

With respect to claims 14,15,18 and 19 wherein the low-dielectric layer is formed on organic spin-on-glass like siloxanes or silicesquinoxanis .(Ye col. 14 line 64-66 , siloxane).

With respect to claims 16,17,20 and 21 wherein the low – dielectric layer is formed of inorganic spin-on-glass like silicate, hydrogen silicate or hydrogen silicesquinoxane. (Ye col. 10 lines 14,21,32-34, col. 14 lines 65-66, glass siloxane , glass –known in the art as non-crystalline solids based on silica, silicon and silicates- E.g.Chambers dictionary of Science and Technology199 ed. Page 510, etc.)

Response to Arguments

Applicant's arguments filed December 11, 2003 have been fully considered but they are not persuasive for the following reasons :

It is noted that Applicants' arguments are based on piece meal attacks on references, it has been held that one cannot show non-obviousness by attacking references individually where, as here, the rejections are based on combinations of references. In re Keller, 208 USPQ 871 (CCPA 1981).

Applicants' first contention that Lau does not teach or suggest shrinking a low dielectric pattern because cross linking is not necessarily the same as shrinking because not every low dielectric film shrinks when cured for cross linking citing SILKTM H as an example of low K dielectric that allegedly does not shrink during curing is not persuasive because :

(a) Applicants' have provided no evidence why they conclude, " Silk does shrink when cured for cross linking " therefore very little or no probative value can be given to this conclusion.

(b) Applicants' by attempting to limit the teachings of Ye to "Silk" only are stating an incomplete list of materials taught by Ye. In fact Ye in col. 23 lines 5 to 20 lists several materials including SILK, FLARE and

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tric materials such as SILK™, an organic polymer similar to BCB (divinylsiloxane bis-benzocyclobutene), which does not contain silicon, available from Dow Chemical Co., Midland, Mich.; FLARE 2.0™, a poly(arylene ether) available from Allied Signal Advanced Microelectronic Materials, Sunnyvale, Calif., which does not contain fluorine, despite its name. Although SILK™, and FLARE 2.0™ have been determined to work well, there are numerous other low k dielectric materials which are expected to behave in a similar manner when etched in accordance with the method of the present invention, using the etch chemistry described herein. Preferably these other low k dielectric materials do not include silicon or fluorine. Other non-fluorine-containing low k dielectrics include poly(arylene) ethers; Poly(arylene)ether oxazoles; Parylene-N; Polyimides; Polynaphthalene-N; Polyphenyl-Quinoxalines (PPQ); Polybenzoxazoles; Polyindane; Polynorbornene; Polystyrene; Polyphenyleneoxide; Polyethylene; Polypropylene; and similar materials.

Therefore even assuming Applicants' conclusion regarding the non-shrinkage of the Silk is true (which is not conceded by the Office) Ye teachings of the several other materials including a plurality of materials that shrink when cured is sufficient to overcome Applicants' conclusion based on incomplete teachings of the materials taught by YE.

Applicants' next contention that neither Ye nor Lau teaches or suggests removing a photo resist pattern and shrinking a low –dielectric pattern at the same time misses the current case law In re Tatincloux 108 USPQ 125 (CCPA 1955) which states , " The performance of two steps simultaneously , which have previously been performed in sequence was held to have been obvious. "

Applicants' contention that Ye and Lau cannot be combined because there is no suggestion or motivation either in Ye and Lau themselves or the knowledge available to one of ordinary skill in the art because the nature of the problem to be solved in the claimed invention is forming fine patterns of a semiconductor device by shrinking a low dielectric pattern and neither Ye or Lau is directed to forming fine patterns of a

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semiconductor device is not persuasive because both Ye and Lau are directed to forming patterns , further none of the claims presently recite “ fine”.

Secondly current case law as stated by In re Gershon, 152 USPQ 602(CCPA1967) is that the mere fact that the references relied upon by the Office fail to evidence an appreciation of the problem identified and solved by the applicant is not standing alone , conclusive evidence of the nonobviousness of the claimed subject matter.

Applicants' next contention that there is no reasonable expectation of success of the combination because there is no evidence in Ye or Lau suggesting modification would be successful is not persuasive because (as stated in the rejection)

Ye does not specifically mention shrinking the low dielectric pattern.

However, Lau, a patent from the same filed of endeavor (both Ye and Lau deal low dielectric layers made from organic polymers Including PTFE, etc. see claim 3 of Ye and col. 1 lines 20-37 of Lau) describes the standard procedure of the shrinking the low-dielectric pattern by curing the low-dielectric pattern (Lau in col.14 line 37 and claim 11 © curing , similar to the Applicants' specification at least pages 6-7 para 16) to cross link the polymers.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Lau's curing (i.e. shrinking of dielectric) step in Ye's method steps to cross-link the polymer of the low dielectric layer . (Lau col. 1 lines 49-61).

Further the inclusion of Lau's curing in Ye' method will be successful in producing a cross linked low dielectric layer.

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Therefore all of Applicant's arguments with respect to claims 1 and 11 are not persuasive and claims 1 and 11 are not allowable.

Dependent claims 3,4 and 12-21 were alleged to be allowable because they depend from allegedly allowable claims 1 and 11.

However as shown above claims 1 and 11 are not allowable and therefore claims 3,4 and 12-21 are also not allowable.

The limitation recited in presently new claims 16-17 and 20-21 are not persuasive for reasons set out under the rejection above.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

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The fax phone numbers for the organization where this application or proceeding is assigned are (703) 7463926 for regular communications and (703) 872-9319 for After Final communications.

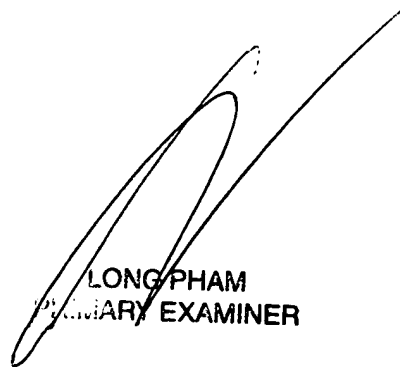
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 3067722.



Steven H. Rao

Patent Examiner

March 23, 2004.



LONG PHAM
PRIMARY EXAMINER